R. POWELL.

INTERNAL COMBUSTION TURBINE MOTOR.

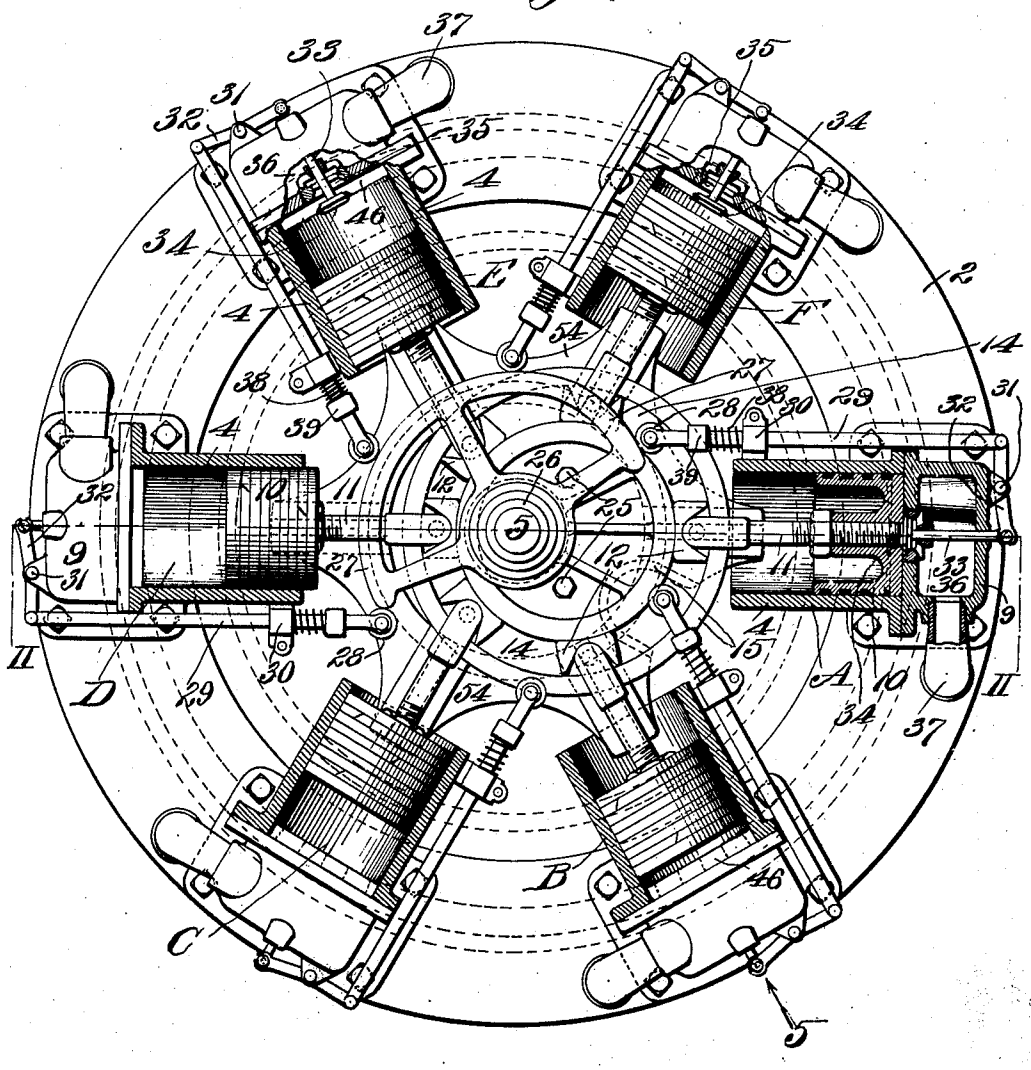
APPLICATION FILED FEB. 14, 1913.

1,116,730.

Patented Nov. 10, 1914.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

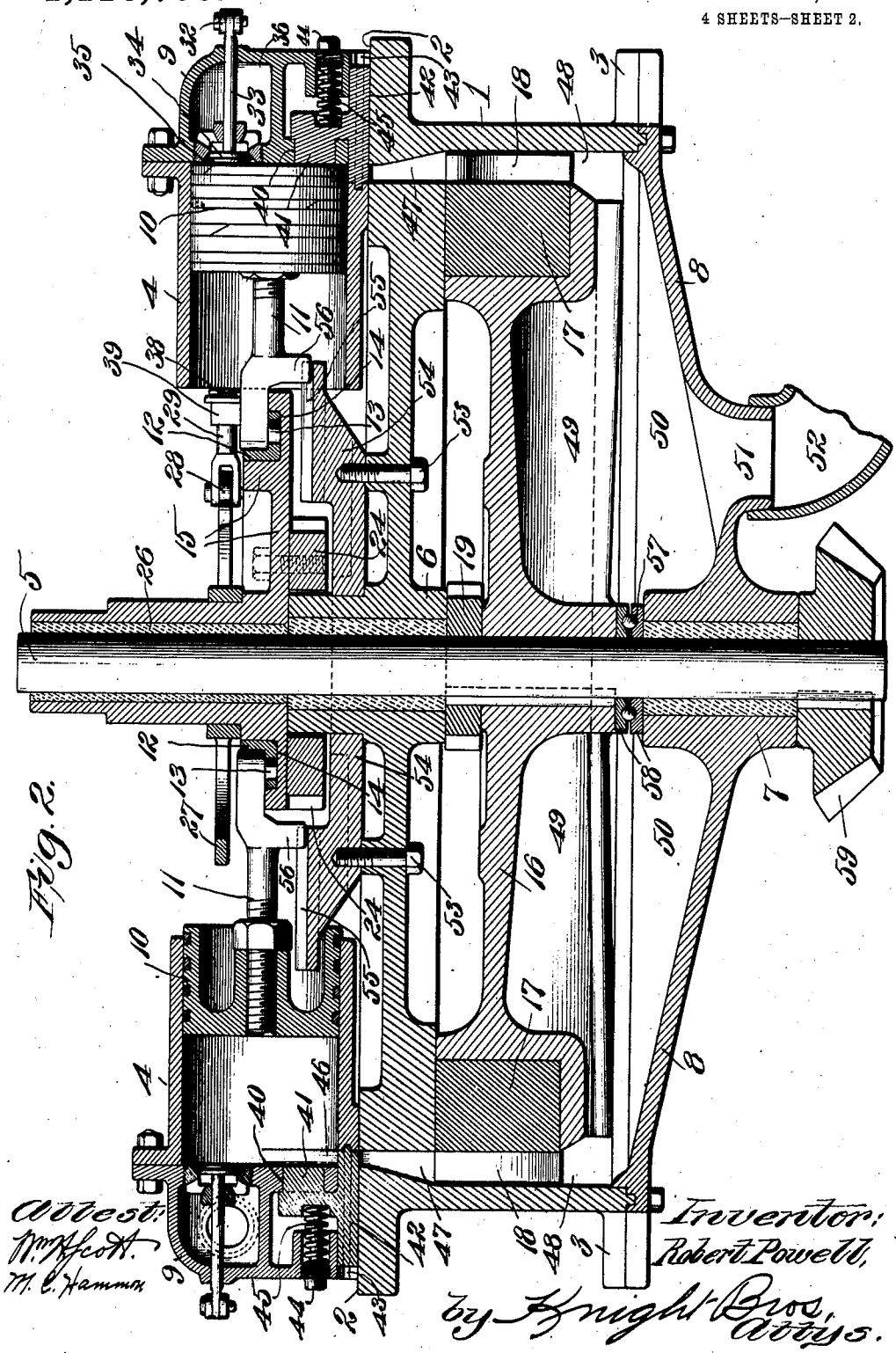


Fig. 2.

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4 SHEETS—SHEET 3.

Fig. 3.

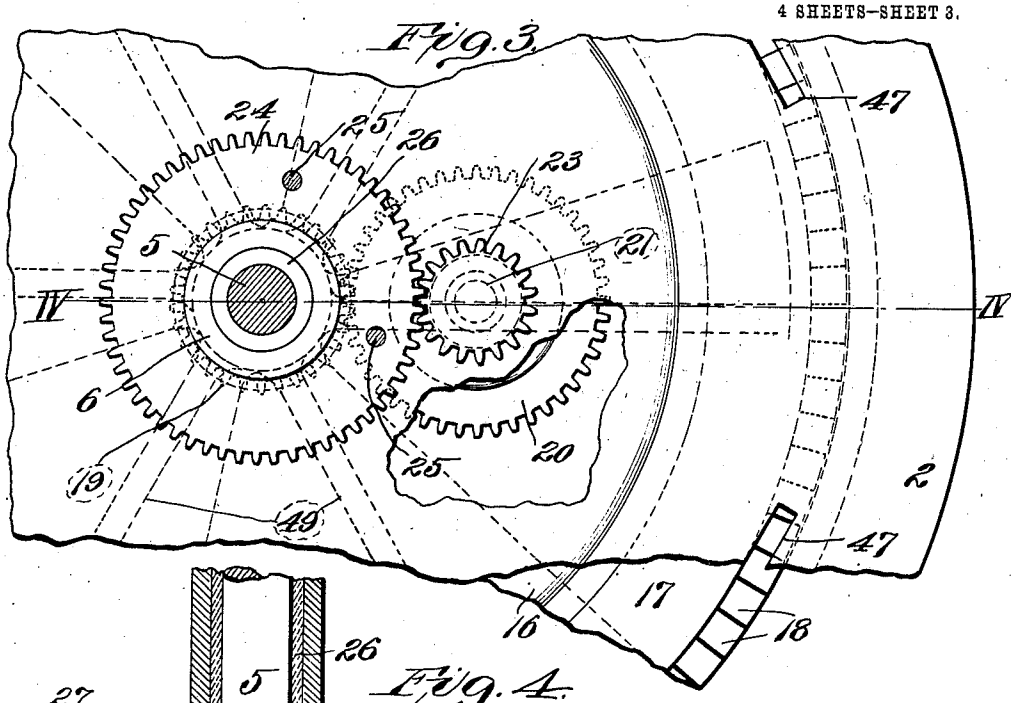
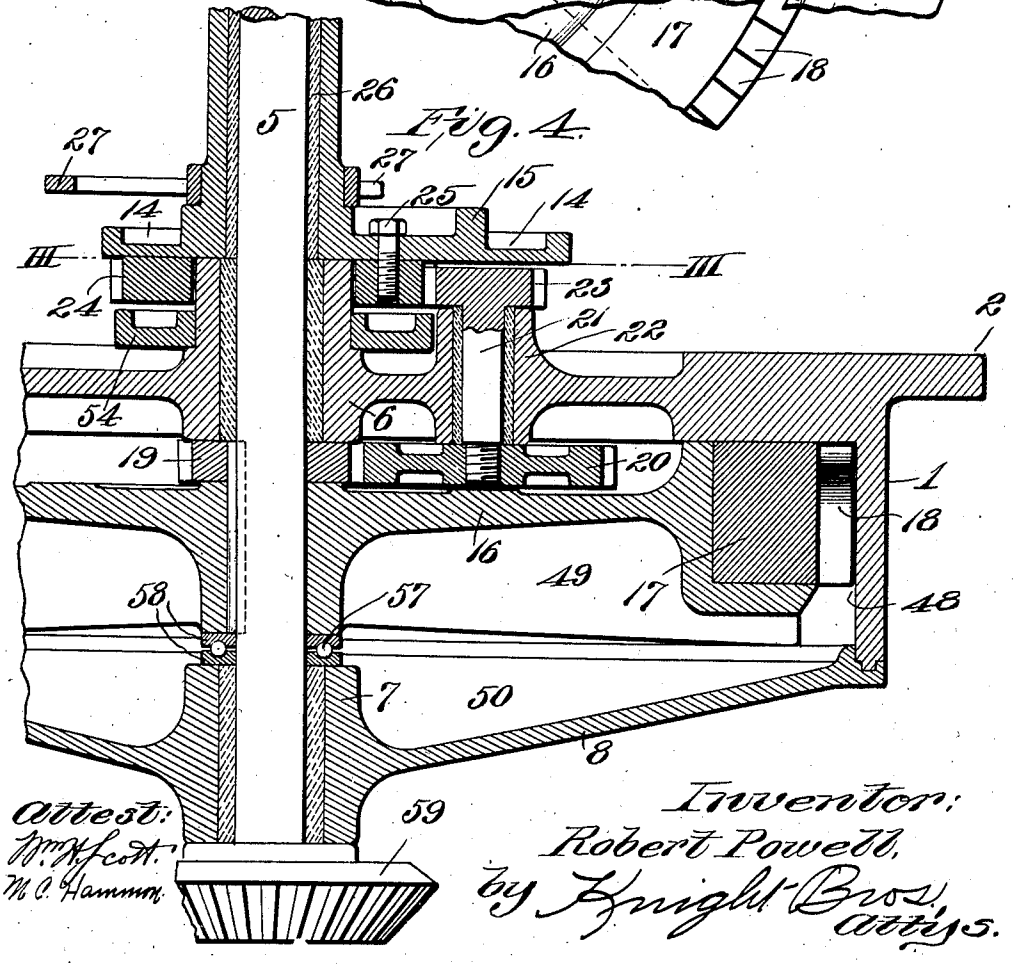


Fig. 4.



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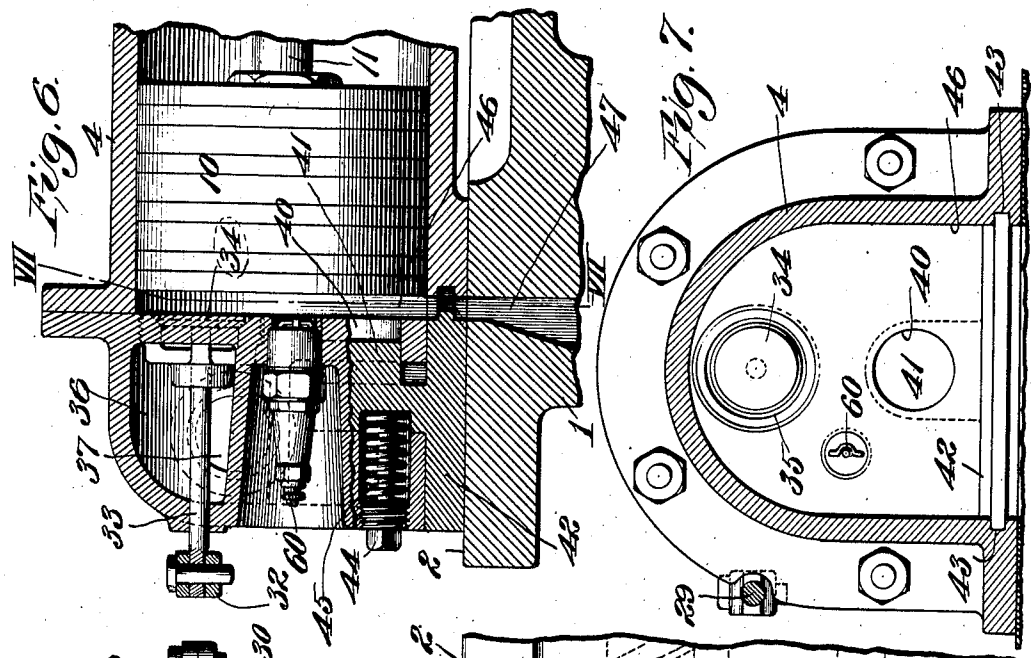


Fig. 6.

Fig. 7.

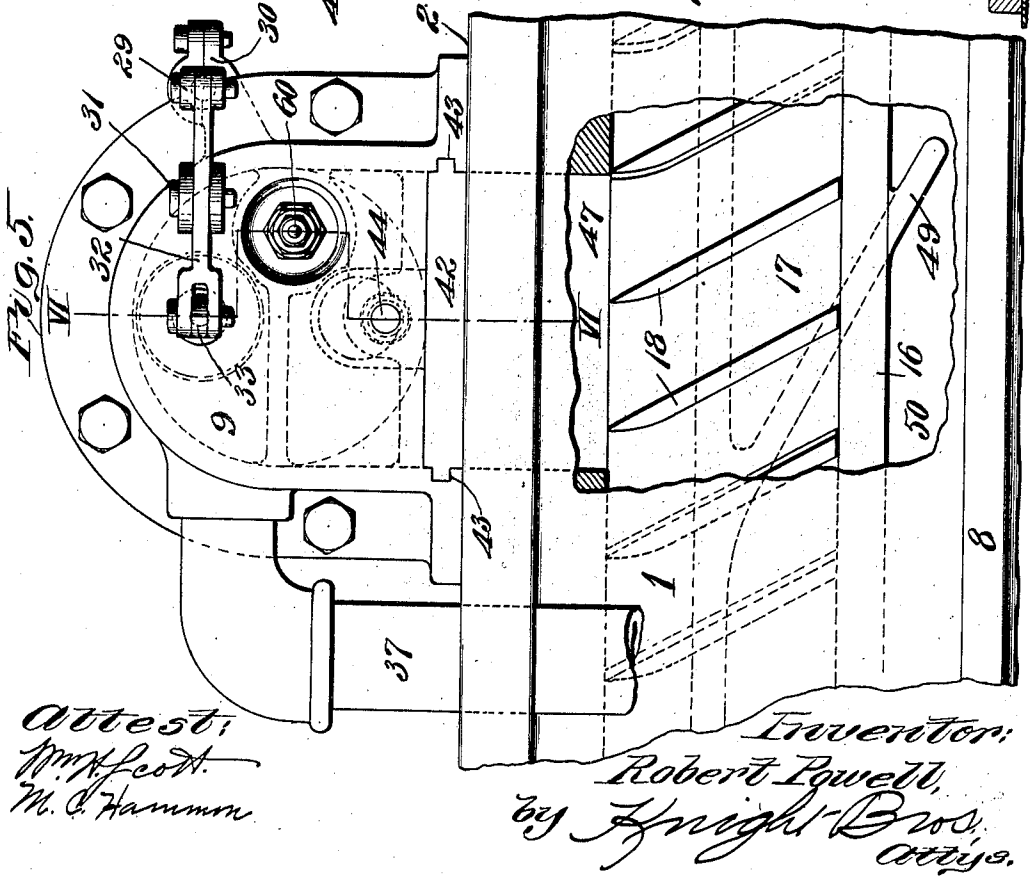


Fig. 5.

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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION TURBINE-MOTOR.

1,116,730. Specification of Letters Patent. Patented Nov. 10, 1914.

Application filed February 14, 1913. Serial No. 748,282.

To all whom it may concern:

Be it known that I, ROBERT POWELL, a citizen of the United States of America, residing in the city of St. Louis and State of Missouri, have invented certain new and useful Improvements in Internal-Combustion Turbine-Motors, of which the following is a specification.

The primary object of this invention is to provide improved means in an internal combustion motor whereby the force of the explosions is discharged directly on the impulse blades of a turbine wheel.

Another object is to attain higher speed by applying the energy of the explosions of an internal combustion motor directly to a revolving shaft, doing so by a turbine wheel mounted on said shaft.

A still further object is to provide improved means in an internal combustion engine of this character whereby the full energy of the explosions is used up on impulse surfaces arranged on a revoluble shaft.

A still further object is to provide an improved motor of this character having a series of impulse blades on the periphery of a horizontal fly wheel whereby gyroscopic action will be given to the vehicle on which it may be mounted.

Other and further objects will appear in the specification, and be specifically pointed out in the appended claims, reference being had to the accompanying drawings exemplifying the invention, and in which,

Figure 1 is a plan view of this improved internal combustion turbine motor, the compression cylinders being shown in section. Fig. 2 is an enlarged vertical section taken on the line II—II, Fig. 1. Fig. 3 is an enlarged plan view of a portion of Fig. 4, taken on the line III—III, thereof. Fig. 4 is an enlarged vertical section taken on the line IV—IV, Fig. 3. Fig. 5 is an enlarged end view of one of the compression cylinders mounted on the turbine wheel casing, a part of said casing being broken away, and taken in the direction of the arrow 5 of Fig. 1. Fig. 6 is an enlarged section taken on the line VI—VI, Fig. 5. Fig. 7 is an enlarged section taken on the line VII—VII, of Fig. 6.

Referring to the drawings, this motor, as shown, is preferably constructed horizontally having a vertical shaft arranged in the center, and a turbine wheel mounted on said shaft. The turbine wheel housing 1 is preferably circular in shape, and on the top side thereof is formed an annular facing 2. This housing 1 serves as a bed plate for the motor and can be fastened to the foundation or frame by the ears 3 formed adjacent the bottom of said housing.

Mounted on the facing 2, adjacent the outside edge thereof, are a series of compression cylinders 4, said cylinders being arranged radially and at equal distances apart around a power shaft 5, which is mounted vertically through the center of the housing 1. Said shaft is sustained in a bearing 6 formed in the upper portions of said housing and a bearing 7 formed in the bottom 8, which bottom 8 forms a closure for said housing 1. The compression cylinders 4 are open at one end, said ends being adjacent the vertical shaft 5. On the opposite ends of said compression cylinders are mounted cylinder heads 9. Reciprocably mounted in said cylinders 4 are pistons 10, said pistons carrying piston rods 11 which are connected to sliding blocks 12 by pins 13, said blocks being mounted in a cam groove 14 of a cam 15.

Securely mounted on the vertical shaft 5 is a turbine wheel 16, said turbine wheel being located in the housing 1. Mounted on the periphery of the turbine wheel 16 is a tire or rim 17 in which is mounted, in any suitable manner, a series of inclined impulse blades 18. Secured to the shaft 5, above the turbine wheel 16, and within the housing 1, is a spur gear 19 meshing with a spur gear 20, which is mounted on the short vertical shaft 21, said shaft 21 being journaled in the bearing 22 formed in the upper portion of the housing 1.

Mounted on the shaft 21, above the bearing 22, is a small spur gear 23 meshing with a larger spur gear 24, said spur 24 being concentrically arranged around the bearing 6 of the vertical shaft 5, and secured to the cam 15 by the cap screws 25. Formed integrally with the cam 15 and extending upwardly therefrom is a hub 26, said hub being formed on the cam 15 at a

distance from the center thereof. Mounted on the hub 26, and secured thereto, is an intermittent cam 27, said intermittent cam being for the purpose of intermittently engaging rollers 28 mounted on the ends of valve operating rods 29. Said valve rods are mounted in bearings 30 on the compression cylinders 4.

Pivotally mounted to each of the cylinder heads 9 by the pivots 31 is a rocking lever 32. One end of each of said rocking levers is connected to the valve rods 29, and the opposite end is connected pivotally to the valve stem 33. The opposite end of said valve stem carries a valve 34, said valve controlling a valve opening 35; said valve being for the purpose of controlling the intake from the intake chamber 36 formed in the cylinder head 9. Said intake chamber is supplied by the mixture supply pipe 37 which leads from a carbureter (not shown). In order to operate the valve rods 29 in opposite directions to those in which they were moved by the intermittent cam 27, springs 38 are mounted on said valve rods between the bearings 30 and collars 39, said collars being secured to said valve rods. Formed on each of said cylinder heads 9, and beneath the inlet valve 34, is a cylindrical opening 40 in which is movably mounted a piston 41, said piston being formed integral with a sliding outlet valve 42. Said valve 42 is slidably mounted in guideways 43 formed adjacent the sides of the valve in the cylinder head 9. Mounted on a stud 44, which is located in each of the cylinder heads 9, is a coil spring 45, said coil spring bearing against the piston portion 41 of the slide valve 42.

Formed in the forward ends of each of the cylinders 4, adjacent the cylinder head 9, and in the lower wall thereof, is a port 46, said port being normally closed by the valve 42. Said port 46, when opened, forms means of communication to the impulse blades 18 of the turbine wheel 16 through openings 47 which are formed in the top of the housing 1.

As shown best in Figs. 2 and 4, the impulse blades 18 are located in an annular chamber 48, said chamber being formed by the tire or rim of the turbine wheel 16 and the wall of the housing 1. Formed in the web of the turbine wheel 16 and on the under side thereof, are a series of fan-like plates 49.

The bottom closure of the housing 1 is of a dish-shape, which provides for an exhaust chamber 50 below the turbine wheel 16, having the outlet 51 communicating with the exhaust pipe 52. Mounted on the top of the housing 1 by the cap screws 53 is a plate 54 having guideways 55. Each one of said guideways is in alinement with the center of each of said cylinders 4. Depending from each of said piston rods 11 are guides 56, said guides engaging the guideways 55 and are for the purpose of keeping the pistons and piston rods in alinement with the cylinders during their reciprocation. The weight of the turbine wheel 16 is sustained by the ball bearings 57 contained in the raceways 58 resting on the hub 7 of the closure 8. Mounted on the lower end of the shaft 5, beneath said closure, is a power transmitting bevel gear 59 in which power is transmitted from this improved motor.

In the operation of this improved internal combustion turbine motor, referring to Fig. 1, the compressed charging mixture from the compression cylinder A has been ignited and discharged. In the compression cylinder B, the mixture has been compressed and is just on the point of being ignited and discharged, whereas in the compression cylinders C and D the charging mixture is under compression, and the cylinders E and F are taking in a mixture charge, and the cylinder A, which has just been discharged, as aforesaid, is about to begin taking in a mixture charge. In order to make the operation clearer, assume that the turbine wheel is rotated in a right-hand direction. Then, the gear 19, mounted on said shaft, will in turn transmit motion to the gear 20 and shaft 21, and pinion 23. Said pinion 23 being in mesh with the gear 24, and the cam 15 being secured to said gear 24, said cam will be turned in a right-hand direction. The intermittent cam 27 being securely mounted to the hub 26 of the cam 15 will also be rotated to the right. The cam 15, on account of the position of the hub 26 on said cam, and because the hub is loosely mounted on the vertical shaft 5, will be eccentric.

The blocks 12 which are slidably mounted in the camway 14 are governed by the position of said camway. Therefore, as shown in Fig. 1, the block 12, which is connected to the piston rod 11 of the piston 10 of the cylinder A, is in the position of the greatest throw of the camway 14. Henceforth, said piston 10 is at the end of its stroke, which means that the explosive mixture, which was contained in the cylinder A, has been fired and discharged, and all the gases have been exhausted from said cylinder. The piston in the cylinder B has compressed the mixture to the firing point and is about to be fired. As the cam 15 moved around one-sixth of a revolution, the cylinder B will have been fired, discharged, and exhausted, and the working parts of said cylinder will then be in the position shown in the cylinder A.

Referring now to Fig. 6, the piston 10, in the position shown, has brought the

charging mixture in the cylinder up to the highest point of compression, and the mixture has just been ignited by the spark plug 60. The explosion of the compressed charge being great caused the piston 41 located in the cylindrical opening 40 to move outwardly, carrying with it the slide valve 42. Said explosion, of course, was great enough to lift the pressure of the coil spring 45, bearing against said piston 41, in such a way as to cause the port 46 to be opened, and the energy of the explosion was discharged through said port 46 into the opening or passageway 47 down onto the impulse blades 18 of the turbine wheel 16. At the same time, the piston 10 on traveling to the end of its stroke entirely cleaned out the burnt gases which were left adjacent the head of said piston and the cylinder head 9. Then, inasmuch as there would be no pressure left in the cylinder to bear against the valve 41, the spring 45 bearing against said valve 41 will carry the slide valve 42 back into its normal position, thus closing the port 46. After the cylinders have been ignited and discharged in turn, as just described, they are in a position to take in a new mixture.

Referring again to Fig. 1 of the drawings, the intermittent cam 27 being carried on the hub 26 of the cam 15, on turning to the right, immediately engages the roller 28 of the valve rod 29 of the just-fired cylinder, thereby pushing said valve rod outwardly and opening the inlet valve 34. As the piston 10 recedes, a new mixture charge is drawn into the compression cylinder. It is to be noted that in cylinder A of Fig. 1, which has just been discharged, the roller 28 and valve rod 29 of said cylinder are being engaged by the cam 27, and the valve 34 is about to be opened, whereas the rollers 28 of the valve rods 29 of the cylinders E and F have been engaged by the cam 27 for a short while and are being filled with the charging mixture. Inasmuch as the inlet valve of the cylinder E was acted on by the cam 27 before cylinder F, cylinder E is nearly filled with the charging mixture. The cam 27 having left the roller 28 of the cylinder D, the valve of said cylinder has just been closed by reason of the action of the spring 38 of the collar 39 on the valve rod 29, and the piston is about to begin on the compression stroke. This is done as the throw of the camway engages the block 12 of the piston rod of said cylinder. It is now readily seen how a number of these cylinders arranged radially around the shaft to be driven will compress and discharge alternately as they are so acted on.

It is not wholly essential to have mechanically operated inlet valves, as it is thought the cam 27 and valve rods 29 and their attachments can be done away with and the valves 34 can be purely of a suction type. It is to be noted that by the radial arrangement of the compression cylinders 4 around the vertical shaft 5 and the guiding arrangement of the piston rods 11 engaging the guideways 55, the pistons and piston rods are always in radial alinement with the center of the vertical shaft 5.

At the time of the exploding of the compressed mixture in the cylinders as shown by the cylinder A, it is to be noted that the block 12 on the piston rod 11 of said cylinder is squarely seated in the cam groove 14 and all of the working parts of said cylinder are in perfect alinement, so that the shock of the explosion against the head of the piston in said cylinder will be well sustained, and the energy from the force of the explosion will be discharged onto the impulse vanes of the turbine wheel, as afore described.

The gearing which is necessary from the drive shaft 5 to the cams which operate the compression and valve control of the cylinders being geared down as shown, cause a ratio of about three revolutions of the turbine wheel to one revolution of the cams, therefore not using so much fuel as they would if they were operated directly from the driving shaft. It is thought that in an engine of this character, constructed horizontally as shown, the speed of the turbine wheel will tend to keep the equilibrium of the vehicle in which it might be mounted. Furthermore, in a motor of this character having a series of compression cylinders in communication with an annular chamber in which is located a series of impulse blades mounted on the periphery of a turbine or fly wheel, the explosions from said cylinders on said impulse blades will act similarly to a continuous blast. And inasmuch as the force of the explosion is discharged on a rotating element, there will be no pounding by reason of the succession of explosions. Whereas, in the reciprocating type of explosive engines, an abrupt shock is common to the pistons as the pistons reach the end of their stroke. As the explosions are discharged in turn from the openings 47 onto the impulse blades of the turbine wheel, they are discharged into the exhaust chamber 50, and the fan-like blades 44 of the turbine wheel serve to drive the exhausted gases into the discharge opening 51. It is thought there will be very little resistance, if any, in said exhaust chamber, as the force of the explosion will be spent in engaging the rotating impulse blades. As said blades are continuous in their order of rotation, the full energy of the blast will be spent against the blades.

In the guiding arrangement of the piston rods 11 by which they are kept in alinement with the pistons 10 and cylinders 4, no side

lashing of the pistons to cause side wear on the cylinders can occur.

What I claim is:

1. In an internal combustion motor, a firing cylinder, a slide valve located in the side wall of said cylinder, and a piston for actuating said valve, said piston forming a portion of one of the end walls of said cylinder.

2. In an internal combustion motor, a firing cylinder, a slide valve located in the side wall of said cylinder, said valve being secured to a piston, said piston adapted to move said valve, said piston being located in the cylinder head of said cylinder.

3. In an internal combustion motor, a cylinder, a turbine wheel located in a housing adjacent said cylinder, a port leading from said cylinder to said housing, said port being formed in the side wall of said cylinder, a slide valve located in said port, and a valve piston secured to said valve, said valve piston being located in the cylinder head of said cylinder.

4. In an internal combustion motor, a firing cylinder, a port formed in the side wall of said cylinder, a valve reciprocably mounted in the side wall of said cylinder, said valve adapted to reciprocate in said port, a cylinder head for said cylinder, an opening formed in said cylinder head, a valve piston reciprocably mounted in said opening, said valve piston adapted to reciprocate said valve.

5. In an internal combustion motor, a turbine wheel, a housing for said wheel, a cylinder secured to said housing, a port leading from said cylinder to said housing, a slide valve located in said port, a valve piston secured to said valve, and a resilient member adapted to bear against said valve piston, said piston being arranged parallel to said valve.

6. In an internal combustion motor, a turbine wheel, a housing for said wheel, an exhaust chamber formed in said housing, fan blades secured to said wheel and adapted to be located in said chamber, a cylinder secured to said housing, a port formed in the side wall of said cylinder leading to said housing, a slide valve located in said port, said valve having a valve piston secured thereto, said valve piston being reciprocably mounted in the cylinder head of said cylinder, and a resilient member adapted to bear against said valve piston.

7. In an internal combustion motor, a turbine wheel, said wheel being mounted on a vertical shaft, a housing for said wheel, an exhaust chamber formed in said housing, fan blades secured to the under side of said wheel, inclined impulse blades mounted on the periphery of said wheel, a series of horizontally arranged cylinders secured to said housing, cylinder heads for said cylinders, said cylinders being radially arranged around said shaft, compression pistons reciprocably mounted in said cylinders, said pistons adapted to receive their reciprocation from said shaft, a port leading from each of said cylinders to the interior of said housing, said ports being formed in the side walls of said cylinders, a slide valve located in each of said ports, each of said slide valves having a valve piston secured thereto, and a resilient member adapted to bear against each of said valve pistons, each of said valve pistons being reciprocably mounted in each of said cylinder heads.

8. In an internal combustion motor, a firing cylinder, a port leading from said cylinder, a slide valve adapted to open and close said port, and a cylinder head for said cylinder, said cylinder head having an opening formed therein, and a piston for actuating said valve reciprocably mounted in said opening of said cylinder head.

9. In an internal combustion motor, a firing cylinder, a cylinder head for said cylinder, a chamber formed in said cylinder head, an opening formed in said cylinder head between said cylinder and said chamber, a port formed in the side wall of said cylinder, a valve reciprocably mounted in said port, a piston secured to said valve, said piston being mounted in said opening and adapted to actuate said valve in one direction, and a resilient member mounted in said chamber adapted to move said valve in the opposite direction.

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In the presence of—
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